DOCUMENT RESUME

ED 273 483 SE 047 185

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TITLE The Mathematics Teacher Development with Peer Tutoring Program.
PUB DATE Apr 86
NOTE 10p.; Paper presented at the Annual Meeting of the American Educational Research Association (67th, San Francisco, CA, April 16-20, 1986).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Calculators; Educational Research; Elementary School Mathematics; Elementary Secondary Education; *Faculty Development; Inservice Teacher Education; *Mathematics Instruction; *Mathematics Teachers; *Retraining; *Secondary School Mathematics; *Tutoring
IDENTIFIERS Mathematics Education Research

ABSTRACT

This project addresses the problem of inadequate mathematics high school teacher staffing and the shortage of mathematics specialists in the elementary school. Regular elementary school teachers interested in becoming certified as high school mathematics teachers, and who had taken at least three college-level mathematics courses, were invited to apply for intensive instruction in high school mathematics (algebra, trigonometry, and analytic geometry). Ten high school mathematics teachers served as tutors for the 40 selected elementary teachers. The three pre-calculus mathematics courses were built around the capability of a programmed calculator. Mathematics achievement tests and the Mathematics Anxiety Rating Scale were administered to participants in September and June, with one test also given in January. For the 29 teachers who completed all tests, almost all mathematics areas showed substantial improvement, and mathematics anxiety decreased significantly. (MNS)

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THE MATHEMATICS TEACHER DEVELOPMENT WITH PEER TUTORING PROGRAM

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Presented at the meeting of the American Educational Research Association
San Francisco, April 1986

SE 047 185

INTRODUCTION

The Mathematics Teacher Development with Peer Tutoring Program (MTDPT) attempts to address the problem of inadequate mathematics high school teacher staffing and the shortage of mathematics specialists in the elementary schools. Two Chicago High School Curriculum Study Groups (the Five-Year Planning Group and the Renaissance Task Force - 1983) have recommended an increase in the minimum mathematics requirememts for high school graduation and a corresponding increase of approximately 770 math high school teachers and 500 elementary school math specialists to meet these future standards. The MTDPT program proposed training Chicago elementary school teachers to become high school math instructors. The feasibility of this approach is based on the documented oversupply of elementary school teachers which currently exists in the Chicago Public Schools due to a declining enrollment of elementary school students.

Regular elementary school teachers who are interested in becoming high school certified math instructors, and had taken at least three college level math courses, were invited to apply for intensive instruction in high school math disciplines (algebra, trigonometry, and analytic geometry) conducted under the joint auspices of the Chicago Public Schools (CPS) Bureau of Mathematics and the National College of Education (NCE). Two members of the Bureau of Mathematics instructed the 40 elementary school teachers selected to participate in the program. Classes were conducted at the designated NCE site on Saturday mornings during the entire Fiscal 1985 school year.

METHODS

Procedure

Ten high school math teachers served as tutors for participating teachers (tutees) on a one-to-four basis. Tutees received four hours of instruction each week. This instruction included supervised tutor huddles (one-half hour) in which the tutee group (four persons) met to review previous material. Group instruction followed in a large classroom. In this intensive session Instructor 1 lectured for 45 minutes introducing new material. A peer tutoring session followed the lecture. The tutoring component was designed to augment the formal lectures, provide feedback/ correctives on weekly quizzes, and endeavor to diminish math anxiety arising in the tutee. Ten groups of four tutees and one tutor met for one hour in smaller rooms encircling the large general instruction classroom. This procedure of a lecture and tutor group was followed a second time with Instructor 2 as lecturer. This allowed the students to receive two different approaches to the material. In addition, intensive tutor/tutee interaction during the week was reported and encouraged by MTDPT staff. The tutees were awarded six hours of university credit upon completion of the program.

The mathematics instruction concentrated on three pre-calculus mathematics courses in a unique instruction sequence. The sequence was built around the capability of the TI-57 LCD programmable calculator. This calculator (distributed to each participating tutee and tutor) can be programed to solve many algebraic, trigonometric and geometric problems. The instruction sequence began with the theory of functions, algebraic equations and inequalities, then conic sections followed by circular

functions and trigonometric identities and equations.

Instruments

The Cooperative Mathematics Tests (CMT), normed on college education majors, were utilized to measure achievement in Algebra III (40 items), Trigonometry (40 items) and Analytic Geometry (35 items). The CMT manual report KR-20 reliability coefficients of (.80 to .84) for those subtests. Content validity is reported as good, and criterion-related validities (Form A) with the School and College Ability Tests (SCAT) are (.58) for Algebra III, (.50) for Trigonometry and (.45) with Analytic Geometry. In addition, a 40 item instrument was developed by the Bureau of Mathematics to measure Algebra I achievement. A KR-20 coefficient of (.77) was obtained for this instrument. Its correlation with the CMT Algebra III instrument was (.51 - Table 1).

Mathematics anxiety was assessed with the Mathemtics Anxiety Rating Scale (MARS). Suinn, Edie, Nicoletti, & Spinelli (1973) report a test-retest reliability coefficient of (.78) after two weeks, and negative discriminant validity correlations of (-.35 and -.32) with DAT cognitive performance. Table 1 also provides evidence of good discrimant validity between the MARS and CMT's.

All instruments were administered twice to participants (September 1984 and June 1985) with the exception of Analytic Geometry which was also administered in January 1985. Twenty-nine (21 females and eight males) of the original 40 elementary school teachers (73%) completed all instrumentation and were in attendance at least 80% of all Saturday morning sessions.

RESULTS

Table 2 presents pretest and posttest mathematics achievement and anxiety data for the 29 participating teachers. Almost all mathematics areas showed substantial and significant improvement. The most dramatic increase from pretest to posttest was on the CMT trigonometry test where the tutees went from the ninth percentile of university education majors (deemed the comparison group - no control group was available for this study), to the 75th percentile. The Algebra 3 achievement was also quite substantial, from the 16th to the 69th percentile. The locally constructed Algebra 1 exam showed the greatest significant increase from pretest to posttest (dependent t-value of 12.14). The Analytic Geometry achievement instrument showed a linear increase from September to January to June administration, however, the magnitude of that increase was disappointing (from the first percentile to the 23rd to the 44th percentiles). Mathematics anxiety as measured by the MARS decreased significantly from pretesting to posttesting (t=3.84).

CONCLUSION

The MTDPT program appears successful in providing to its elementary school teacher sample the prerequisite mathematical concepts and skills for success as high school math certified teachers. The instructional strategy was able to significantly increase math achievement, and decrease math anxiety as measured by standardized tests. This strategy could act as a model teacher training program to alleviate the shortage of high school math teachers. The program could serve qualified elementary school teachers as

an intensive refresher into math concepts and principles, provide them with six pivotal hours of credit, and dramatically shorten the time from completion of program to registration and passing the National Certification Exam for High School Mathematics.

REFERENCES

Educational Testing Service (1964). The Cooperative Mathematics Tests: Handbook and technical report. Princeton, N.J.: Educational Testing Service.

Suinn, R.M. (1972). Mathematics Anxiety Rating Scale (MARS): Information for Users. Ft. Collins, Colorado: RMBSI Inc.

Suinn, R.M., Edie, C.A., Nicoletti, J., & Spinelli, P.R. (1972). The MARS, a measure of mathematics anxiety: psychometric data. Journal of Clinical Psychology, 28, 373-375.

Table 1
Zero-Order Correlations Among All Instruments
n=29

	ALG31	ALG32	TRIG1	TRIG2	GEO1	GEO2	GEO3	ALG11	ALG12	MARS1	MARS2
ALG31	-	35	31	34	35	39	19	51*	24	-23	-24
ALG32		-	-12	72*	14	69*	22	46*	68*	-11	-43
TRIG1			-	17	50*	16	08	43	10	-41	-17
TRIG2				-	30	71*	59*	50*	50*	-09	-34
GEO1					-	42	30	44*	19	15	05
GEO2						-	79*	60*	48*	07	-43
GEO3							-	48*	62*	-09	-39
ALG11								-	71*	-35	-26
ALG12									-	-28	-23
MARS1										-	28
MARS2											-

*P<.01, Decimal Points Eliminated

ALG31 = Alegbra 3 Pretest
ALG32 = Algebra 3 Posstest
TRIG1 = Trigonometry Pretest
TRIG2 = Trigonometry Posttest
GEO1 = Geometry Pretest
GEO2 = Geomtery Midyear
GEO3 = Geometry Posttest
ALG11 = Algebra 1 Pretest
ALG13 = Algebra 1 Posttest
MARS1 = Mathematics Anxiety Pretest
MARS2 = Mathematics Anxiety Posttest

Table 2

Pretest and Posttest Achievement and Math Anxiety Data for Participating Teachers
n=29

	$\bar{x}$	SD	SE	Percentile	Correlation	t-value
Algebra 3 September*	8.86	4.14	.77	16	.35	7.10@
Algebra 3 June	19.62	8.61	1.60	69		
Trigonometry September*	6.59	3.78	.70	09	.17	9.59
Trigonometry June	17.55	5.56	1.03	75		
Analytic Geometry September*	6.62	3.55	.66	01	.42	6.27
Analytic Geometry January	11.55	4.22	.78	23	.79	5.56
Analytic Geometry June	14.86	5.26	.98	44		
Algebra 1 September	19.14	7.00	1.30	48#	.71	12.14
Algebra 1 June	30.48	5.78	1.07	76#		
MARS September**	101.79	22.64	4.20		.28	3.84
MARS June	82.21	23.10	4.29			

= percent correct out of 40 items of a locally constructed (Bureau of Mathematics) test
* = Cooperative Mathematics Tests: Algebra 3 and Trigonometry are 40 items each, Analytic Geometry = 35 items
** = Mathematics Anxiety Rating Scale, 98 items - high scores indicate theoretical high anxiety
@ = All t-values are significant at the .01 level